

Discipline: Electronics
MAN-Manufacturing Technology

Degree Credit [X]
Non Credit []
Nondegree Credit []
Comm Service []

Riverside Community College District Integrated Course Outline of Record

Electronics 64

ELE-64: Programmable Logic Controllers
Same as: MAN- 64

College: R___ M___ N___ X___
Lecture Hours: 36
Lab Hours: 54
Units: 3.00

COURSE DESCRIPTION

Prerequisite(s): None.

Advisory: ELE 10 or ELE 21

Fundamentals of programmable logic controllers, with an emphasis on introductory programming of PLCs. Problem analysis with solutions that integrate programming formats, auxiliary commands and functions, common programming languages, and popular software programs used with PLCs. Installation, maintenance, troubleshooting and repair are inherent components. 36 hours lecture and 54 hours laboratory. (Letter Grade, or Pass/No Pass option.)

SHORT DESCRIPTION FOR CLASS SCHEDULE

Fundamentals of programmable logic controllers. Programming, installation, maintenance, troubleshooting and repair of PLC systems. (Same as MAN-64)

ENTRY SKILLS

Before entering the course, students will be able to:

1. Demonstrate quantitative measurement of electrical circuit parameters; assemble, and test both direct current series, parallel, and series parallel circuits.
 - ELE 21 - Explain the relationship between current, voltage, resistance and power.
 - ELE 10 - Demonstrate quantitative measurement of electrical circuit parameters; assemble, and test both direct current and alternating current series, parallel, and series parallel circuits.
2. Conduct direct circuit analysis and measurement.

- ELE 21 - Explain the relationship between current, voltage, resistance and power.
 - ELE 10 - Conduct direct circuit analysis and measurement.
3. Use function of resistors, switches, light bulbs, capacitors, and inductors in actual circuits.
 - ELE 10 - Use function of resistors, switches, light bulbs, capacitors, and inductors in actual circuits.
 4. Analyze DC in transient and resonant circuits; analyze circuits using Ohm's Law, and Kirchhoff's Laws.
 - ELE 10 - Analyze DC and AC in transient and resonant circuits; analyze circuits using Ohm's Law, Kirchhoff's Laws, and network theorems.
 5. Demonstrate the operation transistors, line operated DC power supplies, amplitude and frequency modulation.
 - ELE 10 - Demonstrate the operation and construction of vacuum tubes, transistors and transistor amplifiers, line operated DC power supplies, sinewave oscillators, amplitude and frequency modulation, and amplitude modulation receivers.
 6. Demonstrate the operation of electronic lab equipment to test components and circuits by properly connecting and operating the following standard test equipment: power supplies, ammeters, voltmeters, ohmmeters, analog and digital multimeters, and oscilloscopes.
 - ELE 10 - Demonstrate the operation of electronic lab equipment to test components and circuits by properly connecting and operating the following standard test equipment: power supplies, function generators, ammeters, voltmeters, ohmmeters, analog and digital multimeters, oscilloscopes, and bridges.

STUDENT LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

List and discuss advantages and disadvantages of PLCs.

- Communication Skills - Write with precision and clarity to express complex thought
- Communication Skills - Speak with precision and clarity to express complex thought
- Information Skills - Locate, evaluate and use information effectively

Describe the functions of the major parts of a PLC system.

- Information Skills - Locate, evaluate and use information effectively
- Communication Skills - Speak with precision and clarity to express complex thought

Describe and demonstrate how the parts of the PLC system are connected electrically.

- Communication Skills - Speak with precision and clarity to express complex thought
- Information Skills - Locate, evaluate and use information effectively

- Information Skills - Demonstrate computer literacy
- Breadth of Knowledge - Use the symbols and vocabulary of mathematics to solve problems and communicate the results

Analyze problems representative of control system environments using PLC.

- Communication Skills - Read college-level materials with understanding and insight
- Critical Thinking - Generalize appropriately from specific contexts
- Information Skills - Locate, evaluate and use information effectively
- Critical Thinking - Analyze and solve complex problems across a range of academic and everyday contexts

Create ladder logic programs using popular programming software and test for correct operation.

- Information Skills - Locate, evaluate and use information effectively
- Critical Thinking - Integrate knowledge across a range of contexts
- Information Skills - Demonstrate computer literacy
- Application of Knowledge - Maintain and transfer academic and technical skills to workplace

Demonstrate the installation maintenance and troubleshooting of PLCs and PLC modules.

- Global Awareness - Demonstrate teamwork skills
- Critical Thinking - Integrate knowledge across a range of contexts
- Communication Skills - Read college-level materials with understanding and insight
- Information Skills - Demonstrate computer literacy

COURSE CONTENT

1. PLC and Electrical Safety
 - a. Power supply connections
 - b. input and output connections
 - c. communication connections that present a possible shock hazard.
2. Electrical Principles and PLCs
 - a. PLC as an electrical part of a much larger electrical system.
 - b. Input devices (switches and sensors)
 - c. Output components (motor starters and lights)
 - d. How to install, maintain and troubleshoot
 - e. Electrical properties
 - i. voltage
 - ii. current
 - iii. power
 - iv. resistance

3. Electrical Circuits and PLCs
 - a. Symbols
 - b. Ladder Logic Diagrams.
4. PLC Hardware
 - a. input section
 - b. output section
 - c. power supply
 - d. central processing unit (CPU)
 - e. programming device
5. PLC Programming Instructions
 - a. Testing: Force Inputs & Outputs
 - b. Troubleshooting: Tnd, Jmp & LBL
6. Programming PLC Timers and Counters
 - a. TON Timer Instruction
 - a. TOF
 - b. RTO
 - c. CTU & CTD
7. PLC and System Interfacing
 - a. Networking
 - b. Serial Communications
8. PLC Installations and Start up
 - a. Preparing the PLC
 - b. PLC enclosures
 - c. Electrical Noise
 - d. Power Supplies
 - e. Safety and wiring
9. PLC and System Maintenance
 - a. Hardware
 - b. Software
10. Troubleshooting Principles for PLCs
 - a. Methods
 - b. Tools
 - c. Strategies

METHODS OF INSTRUCTION

Methods of instruction used to achieve student learning outcomes may include, but are not limited to:

- Class lectures/discussions/demonstrations in order to show the students how Programmable Logic Controllers are to control machines
- Showing videos in order to give the students a better understanding of how PLCs are used to in industry
- Creating and assigning pair and small group activities such as using PLCs to perform tasks that would apply to industry
- Developing and assigning class exercises such designing an electrical diagram that would properly apply usage of PLCs to perform tasks such as sensing when a person enters a room

- Conducting individual conferences in order to help the students understand how usage of PLCs apply to what they are doing within their job;
- Assigning lab projects that help the students show they can use PLCs to perform different tasks
- Field trips that would give the students an opportunity to see how PLCs are used in industry.

METHODS OF EVALUATION

Students will be evaluated for progress in and/or mastery of learning outcomes by methods of evaluation which may include, but are not limited to:

- Lab projects designed to show the student is adept at using PLCs to create programs and hardware systems to perform tasks. These lab projects can then be used by the student to show future or current employers what they created during class.
- Quizzes/examinations designed to test the students' understanding of the operation of PLCs.
- Written and verbal presentation assignments designed to give the students experience in researching and presenting some aspect of usage of PLCs within industry.

SAMPLE ASSIGNMENTS

Outside-of-Class Reading Assignments

- Read selected chapters from the textbook including:
 - Programmable Logic Controller (PLC) Overview
 - PLC and Control system components
 - Number Systems and Codes
 - Creating Relay Logic Diagrams
 - PLC Programming
 - Programming Logic Gate Functions in PLCs
 - PLC Timer Functions
 - PLC Counter Functions
 - PLC Math Functions
 - PLC Logic Functions
 - PLC Compare, Jump and MCR Functions
 - PLC Subroutine Functions
 - Sequencer functions
 - PLC Networks in Manufacturing
 - Troubleshooting and Servicing the PLC system

Outside-of-Class Writing Assignments

- Writing assignment requiring the students to write a 3 page paper about how PLCs are used in industry to control robotic systems.

Other Outside-of-Class Assignments

- Prepare as a team to present to the class your research results of how PLCs are used to control robotic systems.

COURSE MATERIALS

All materials used in this course will be periodically reviewed to ensure that they are appropriate for college level instruction. Possible texts include:

- L. A. Bryan, E. A. Bryan . Programmable Controllers Theory and Implementation. 2nd ed. American Technical Publishers,, 1997.
- Mazur, Glen A. & Weindorf, William J. . Introduction to Programmable Logic Controllers. . 2nd ed. American Technical Publishers, Inc. , 2011.
- Rabiee, M.. Programmable Logic Controllers Hardware and Programming. 2nd ed. Goodheart Willcox, 2009.

01/24/2012

4226